$$\beta = (2\pi/\lambda) \times \text{Modal Index}$$
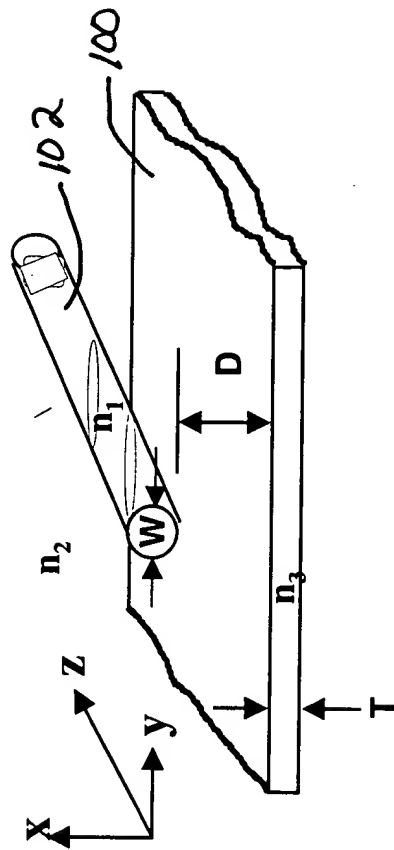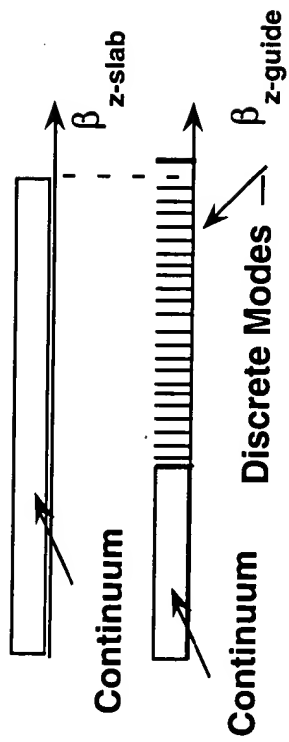

Fig. 1
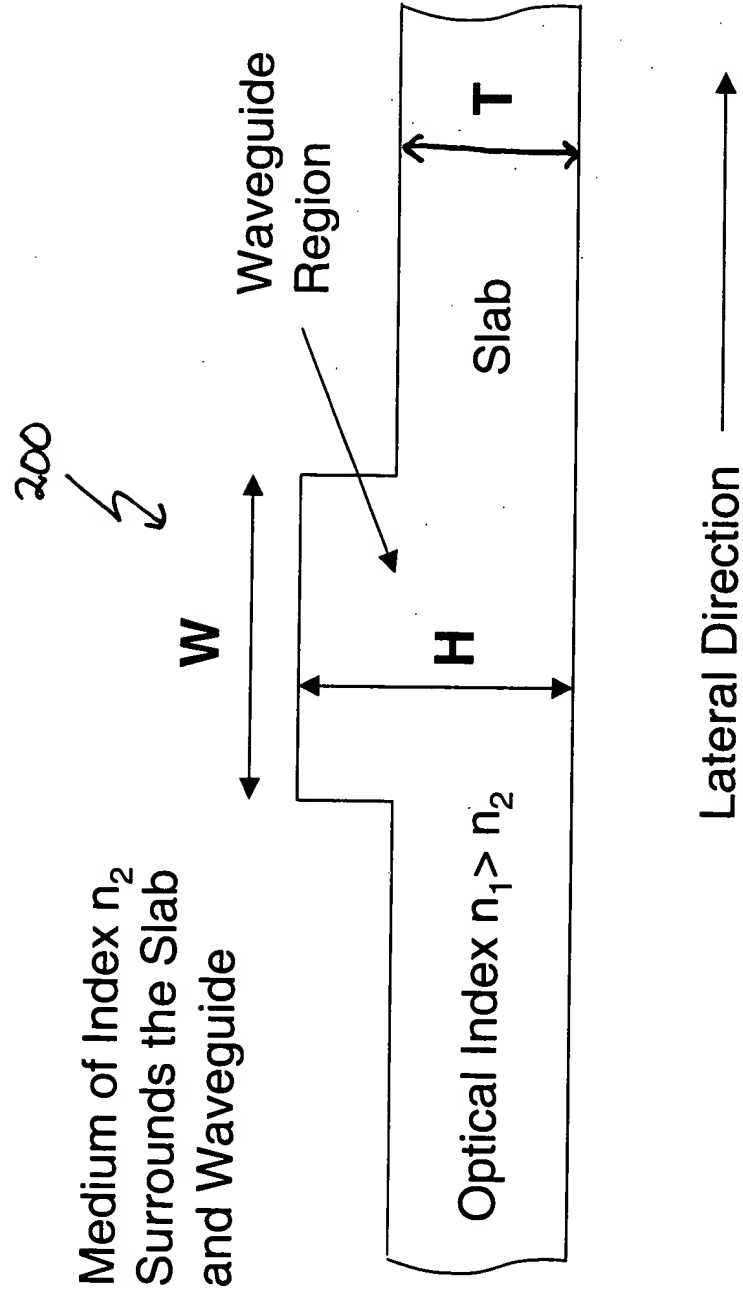
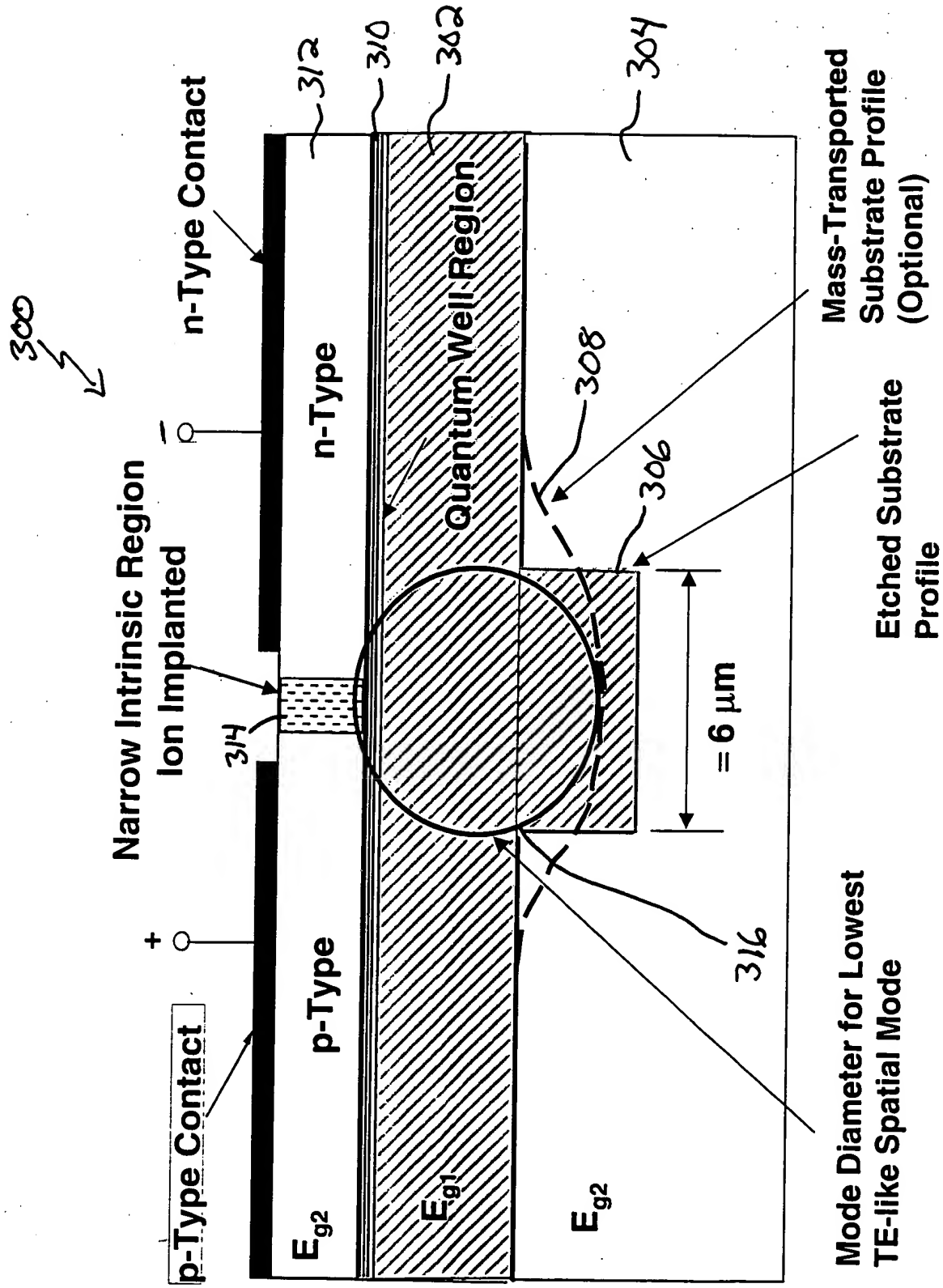Fig. 2

Fig. 3

Oxide Insulation

Quantum Well Region

p-Type Cap

p-type contact

n_2

$n_1 > n_2$

Low doping=10^{17}cm^{-3} n-Type

n_2

n-Type Buffer and Substrate

n-type contact

InP

GaInAsP

InP

400

416

452

414

412

410

418

420

408

406

404

422

Fig. 4

Fig. 5

600

Bounding layer n_{23} ~606

Quantum Wells n_{21} (gain)   ~602

Barriers n_{22} ~604

Quantum Wells n_{21} (gain)   ~602

Repeat N times

Quantum Wells n_{21} (gain)   ~602

Bounding layer n_{23} ~606

t_{bound} t_{QW} t_{bar}

E_C

E_{g23}

E_V

E_{g21}

E_{g22}
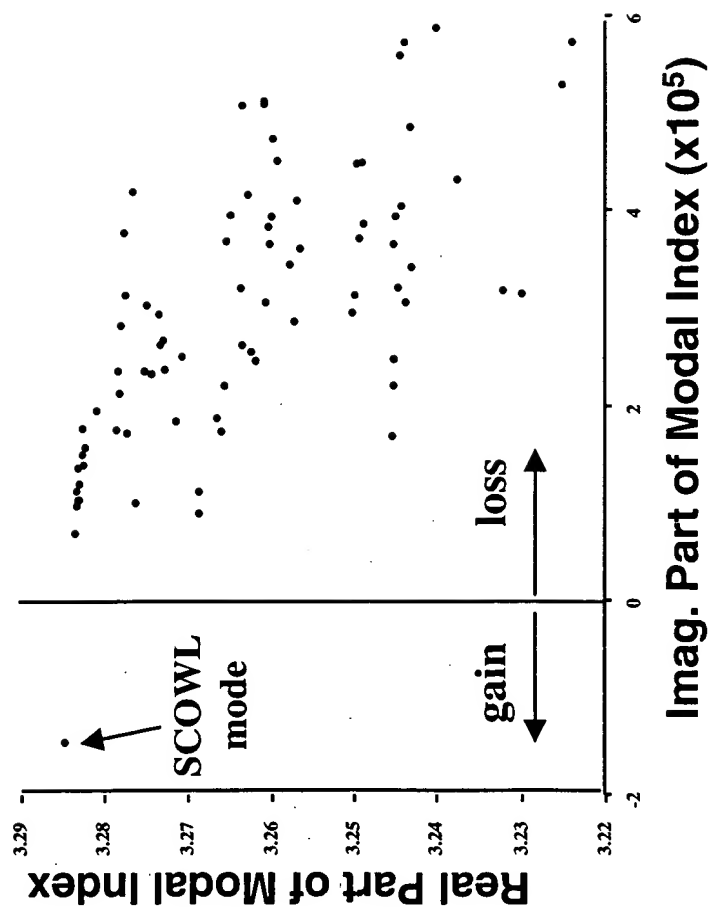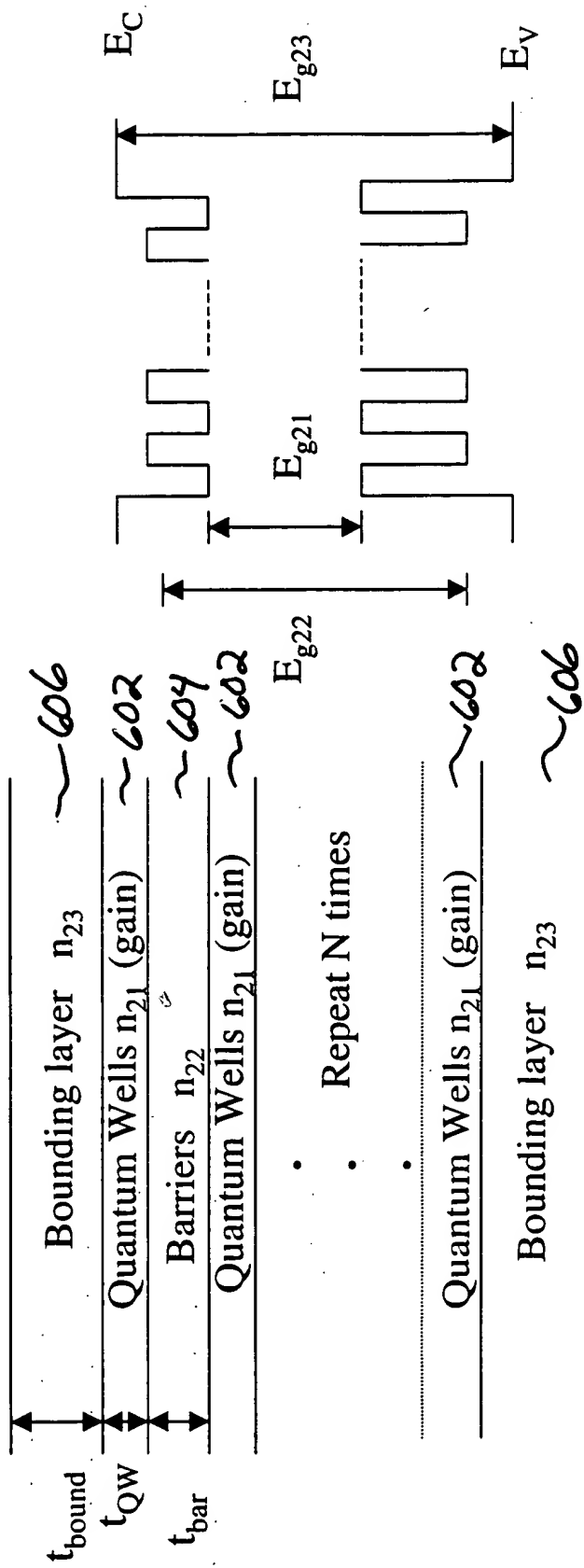
$n_{21} > n_{22} \geq n_{23} \geq n_1 > n_2$

$E_{g21} < E_{g22} \leq E_{g23} \leq E_{g1}$

MQW Region Band Diagram

Fig. 6

Fig. 7

Fig. 8

Fig. 9
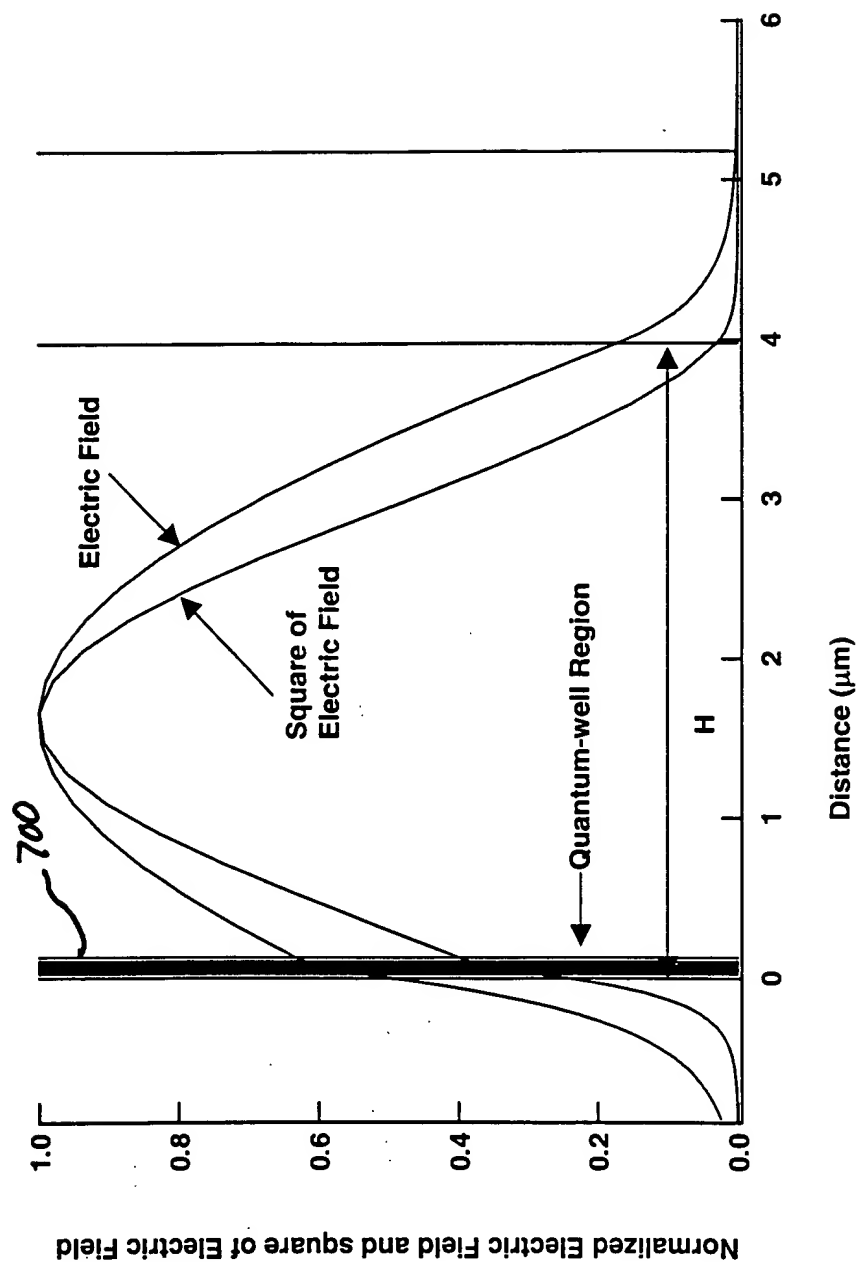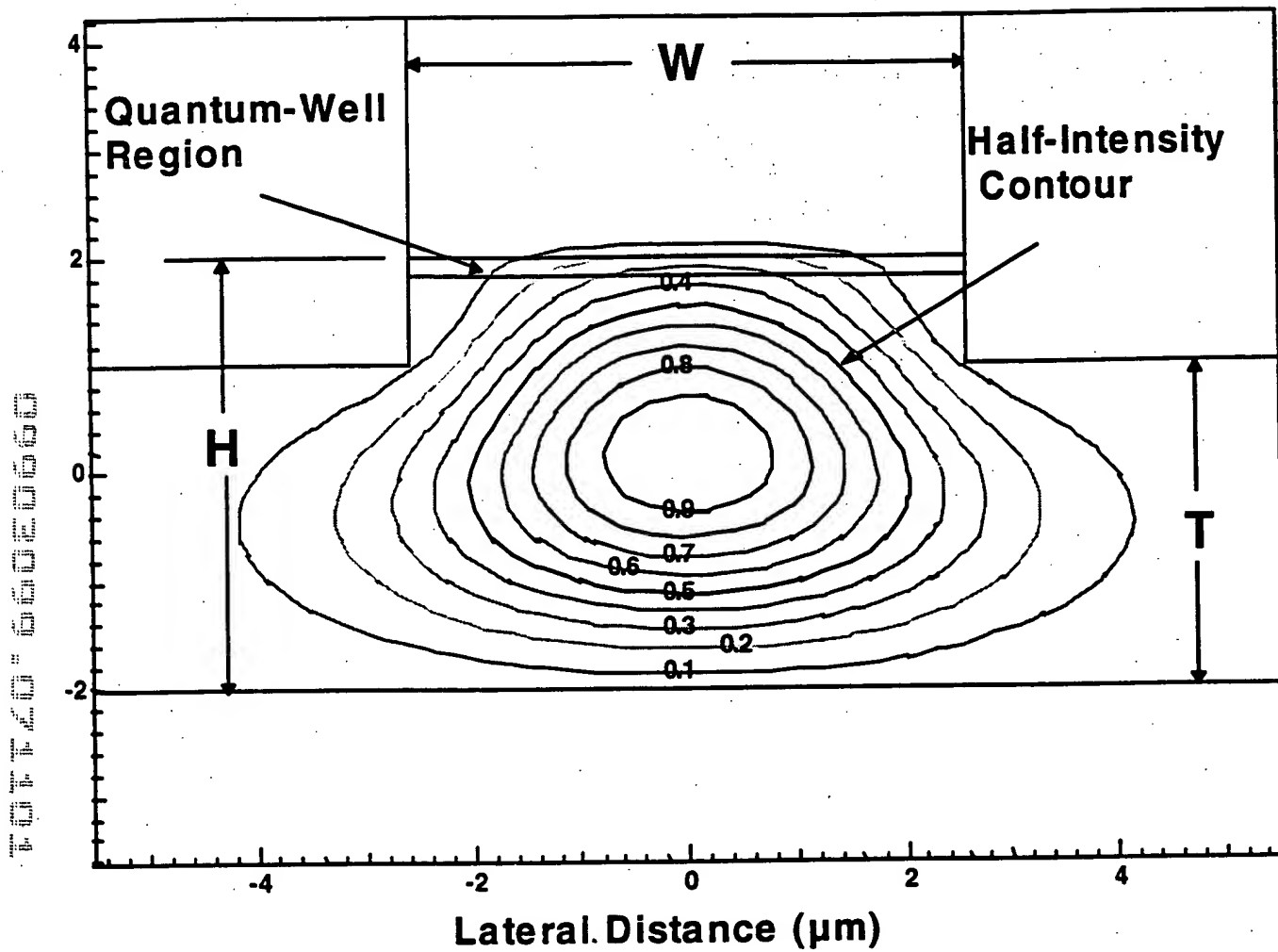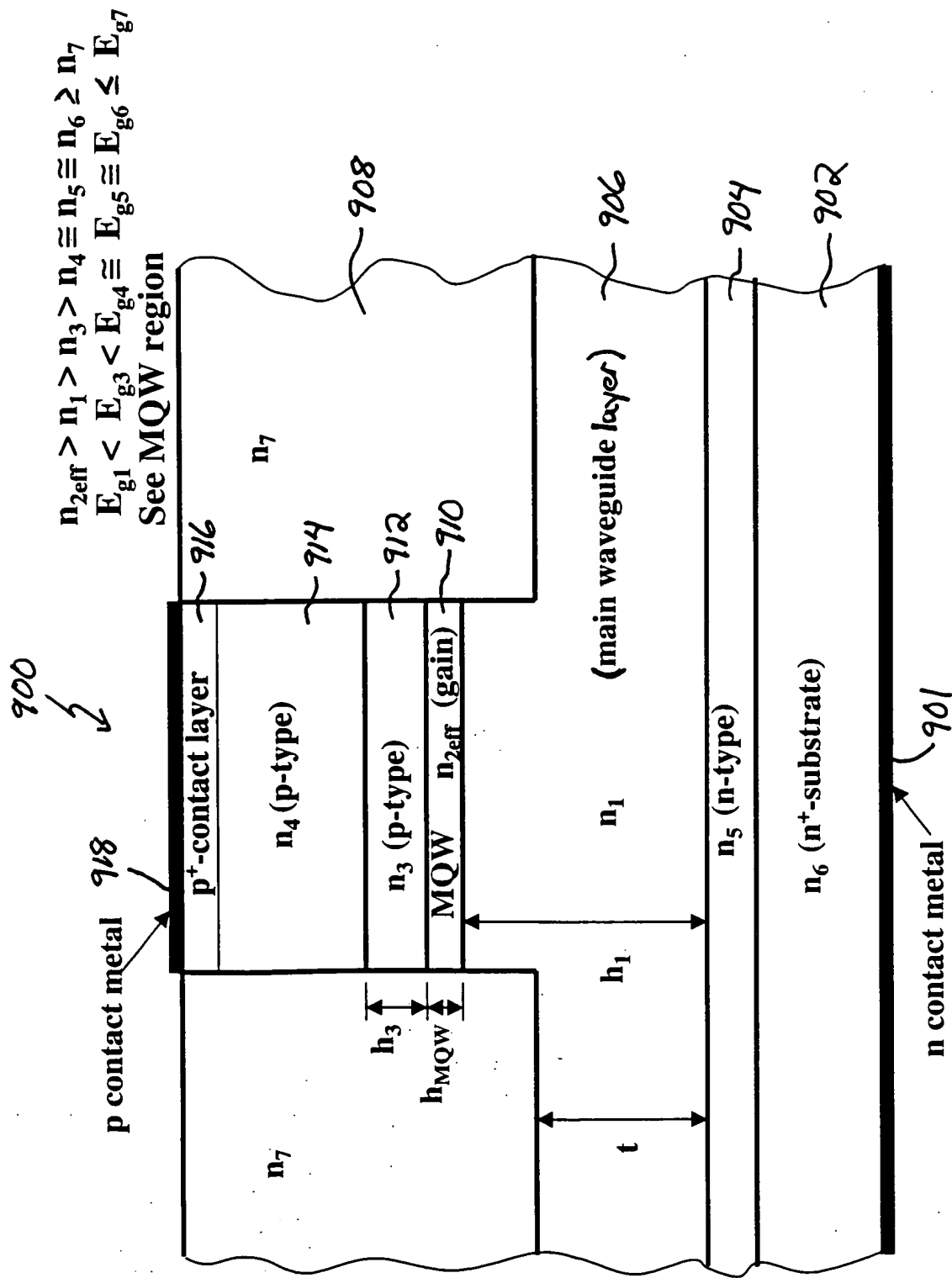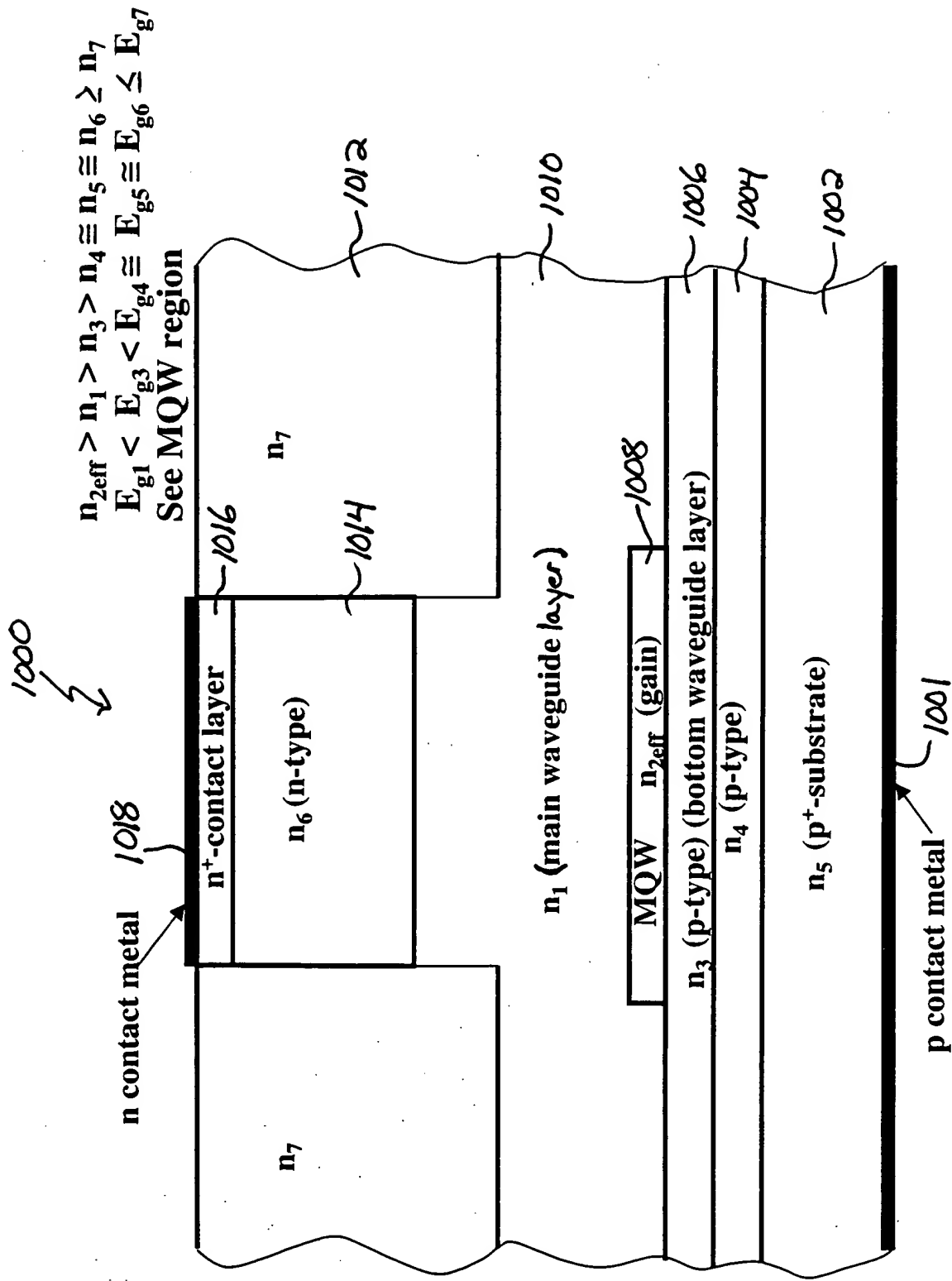
$n_{2eff} > n_1 > n_3 > n_4 \cong n_5 \cong n_6 \geq n_7$

$E_{g1} < E_{g3} < E_{g4} \cong E_{g5} \cong E_{g6} \leq E_{g7}$

See MQW region

Fig. 10

$$n_{2eff} > n_1 > n_3 > n_4 \cong n_5 \gtrless n_6$$
$$E_{g1} < E_{g3} < E_{g4} \cong E_{g5} \lesssim E_{g6}$$

p contact metal

1116

p^+-contact layer

1114

n_3 (p-type)

1112

n_6

n_6

n_1 (main waveguide)

1110

QW region
n_{2eff} (gain)

1108

n_4 (n-type)

1106

1104

n_5 (n^+-substrate)

1102

n contact metal

1101

1100
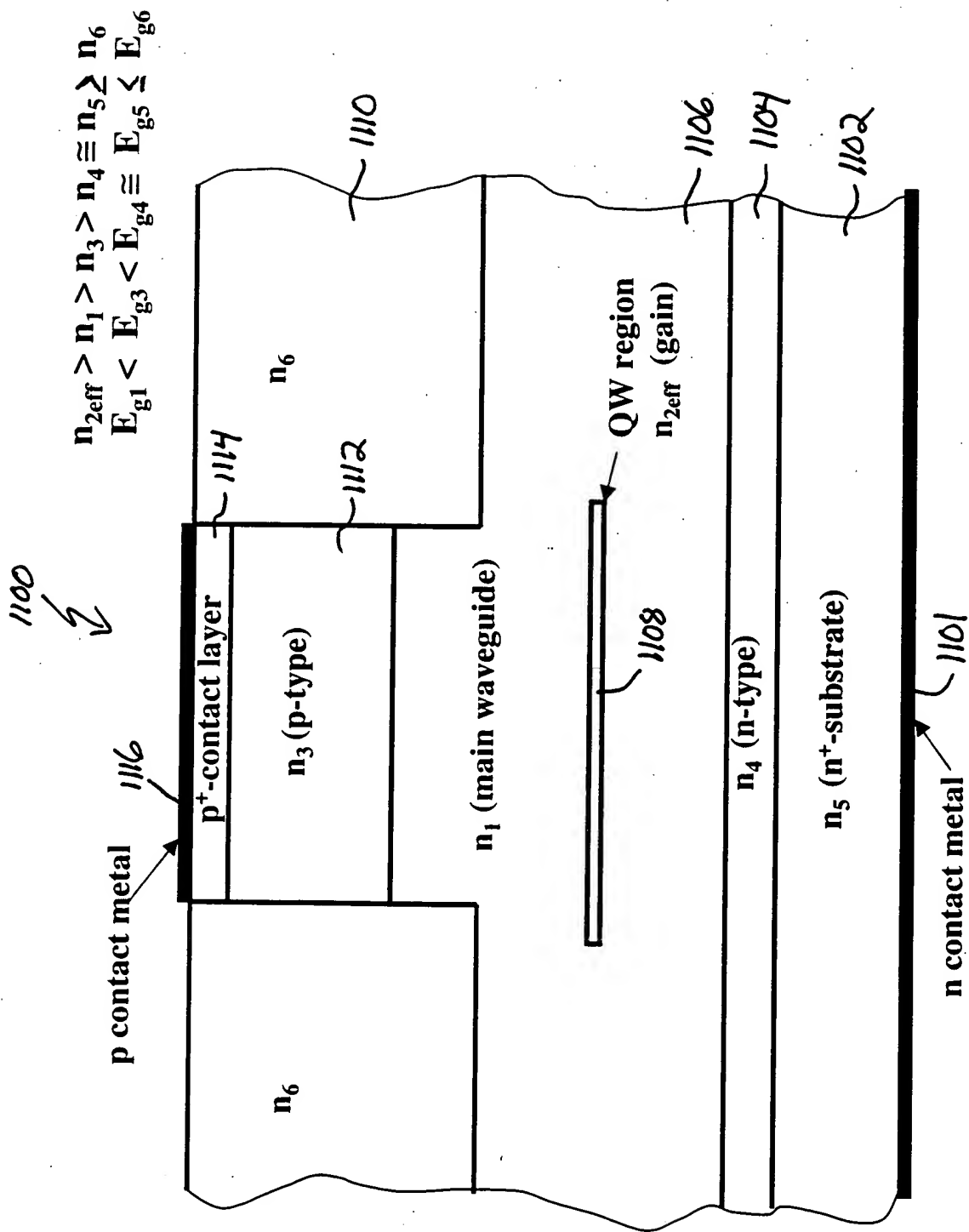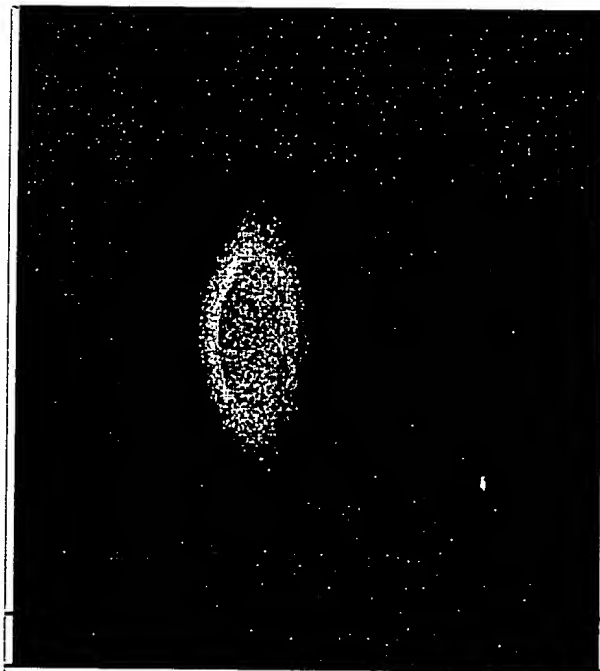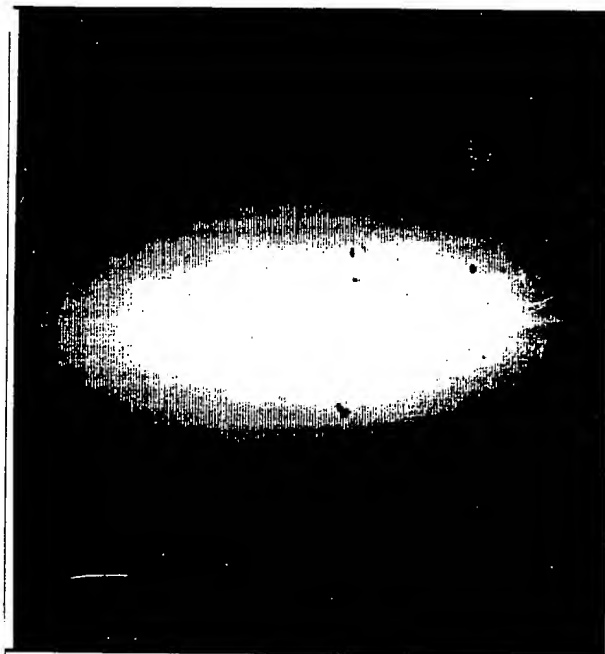
Fig. 11

Near-Field
Mirror Illumination Pattern

4 µm

Fig. 12A

Far-Field Pattern

~8°

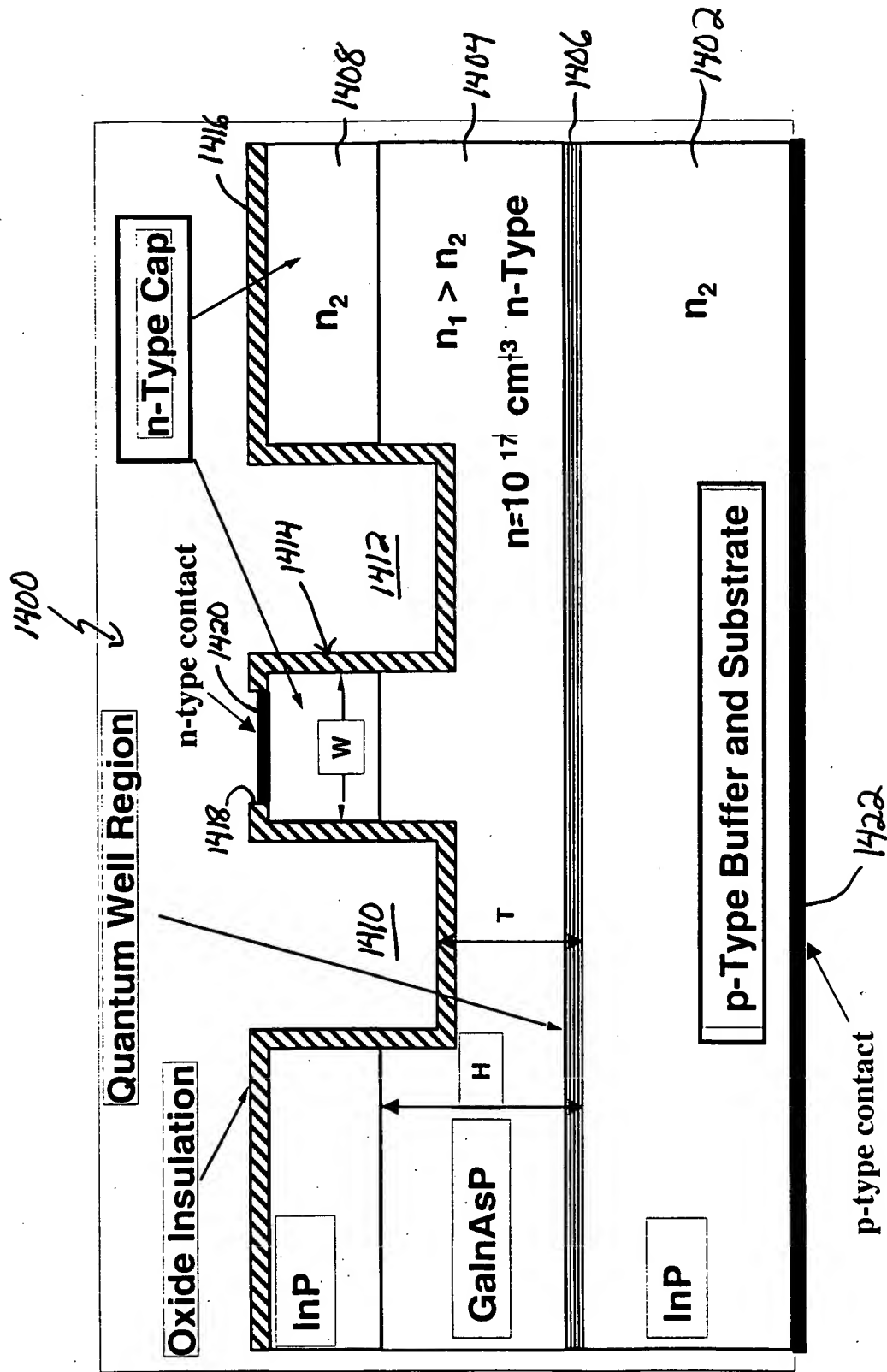Fig. 12B

Near-Field Pattern

Far-Field Pattern

Half-Intensity Contours

Fig. 13A

Fig. 13B

Fig. 14

1400

1416 — n-Type Cap
1408 — n_2
1404 — $n_1 > n_2$
1406
1402 — n_2

Oxide Insulation

Quantum Well Region

n-type contact
1420
1414
1412
1418

W

InP

GaInAsP

H

T

1410

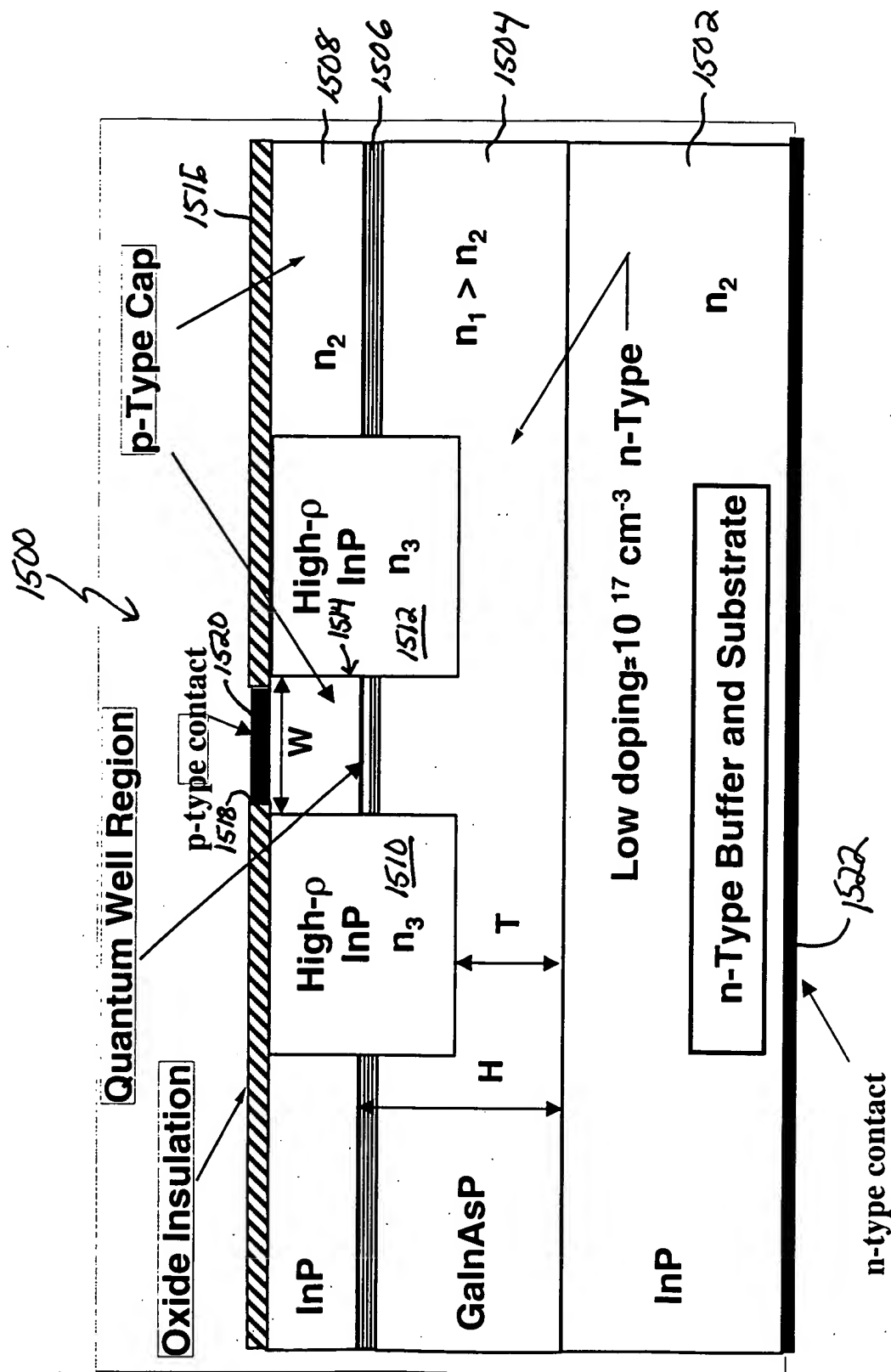$n=10^{17}$ cm^{-3} n-Type
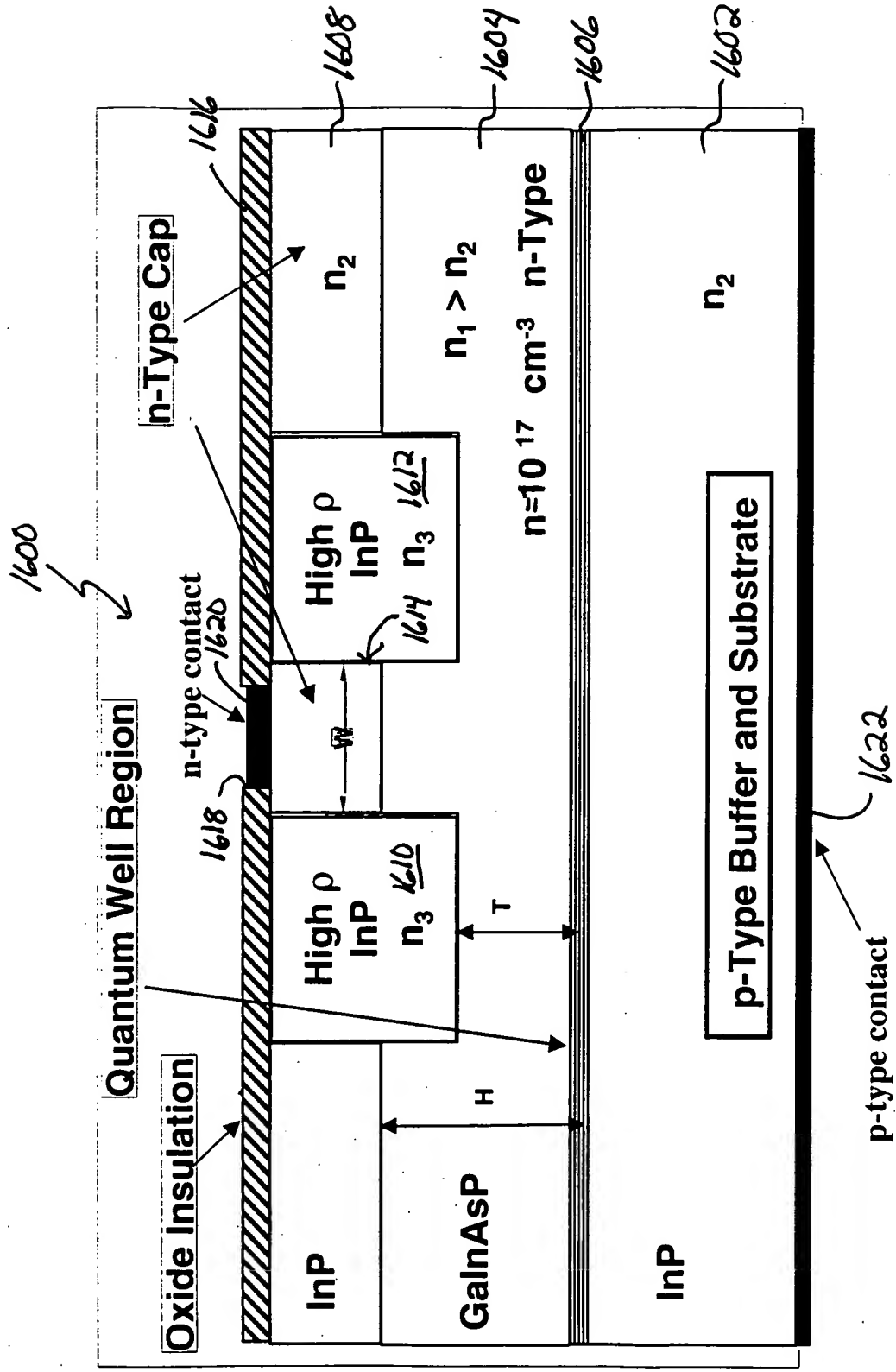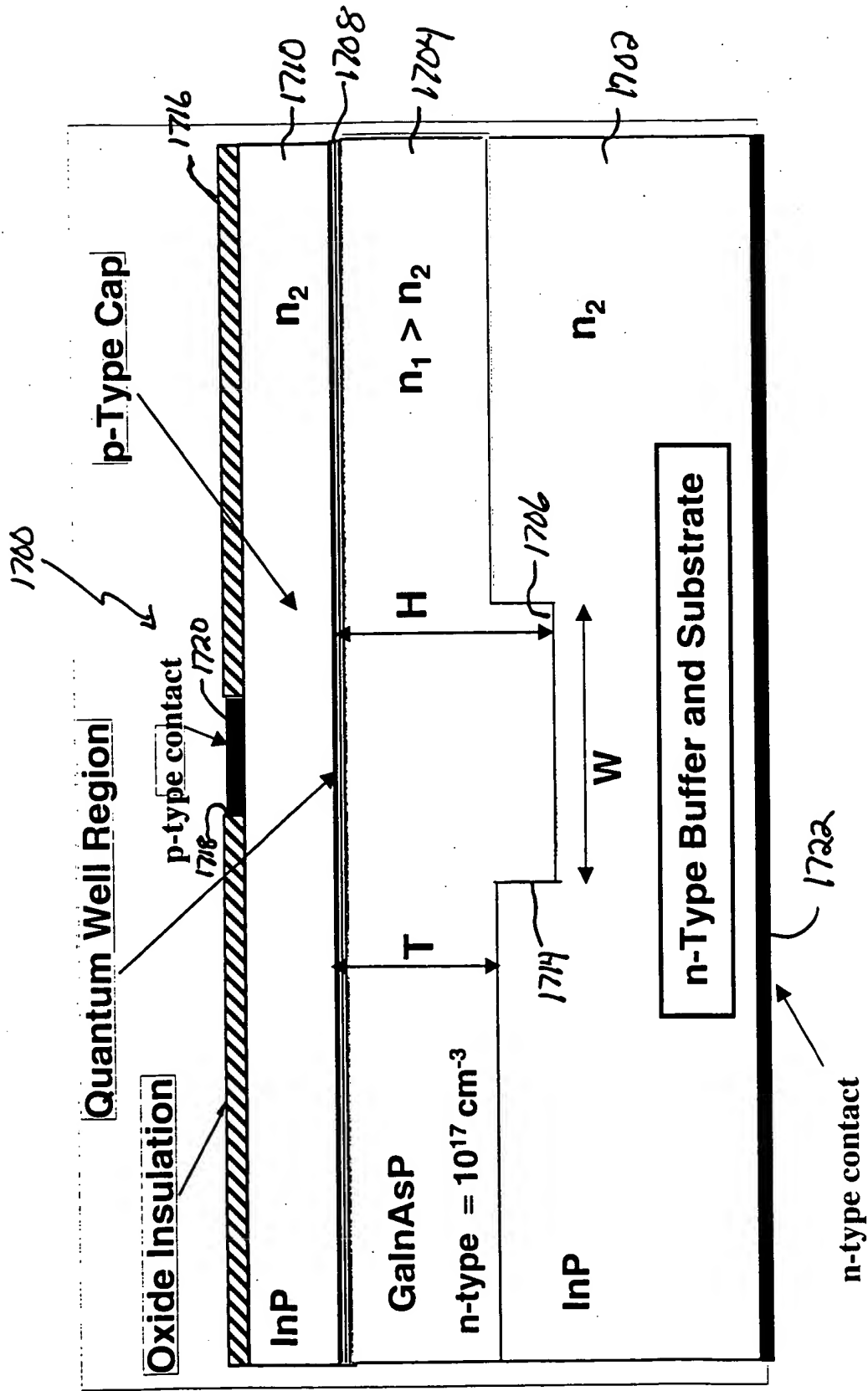
p-Type Buffer and Substrate

InP

p-type contact

1422

Fig. 15

Fig. 16

Fig. 17
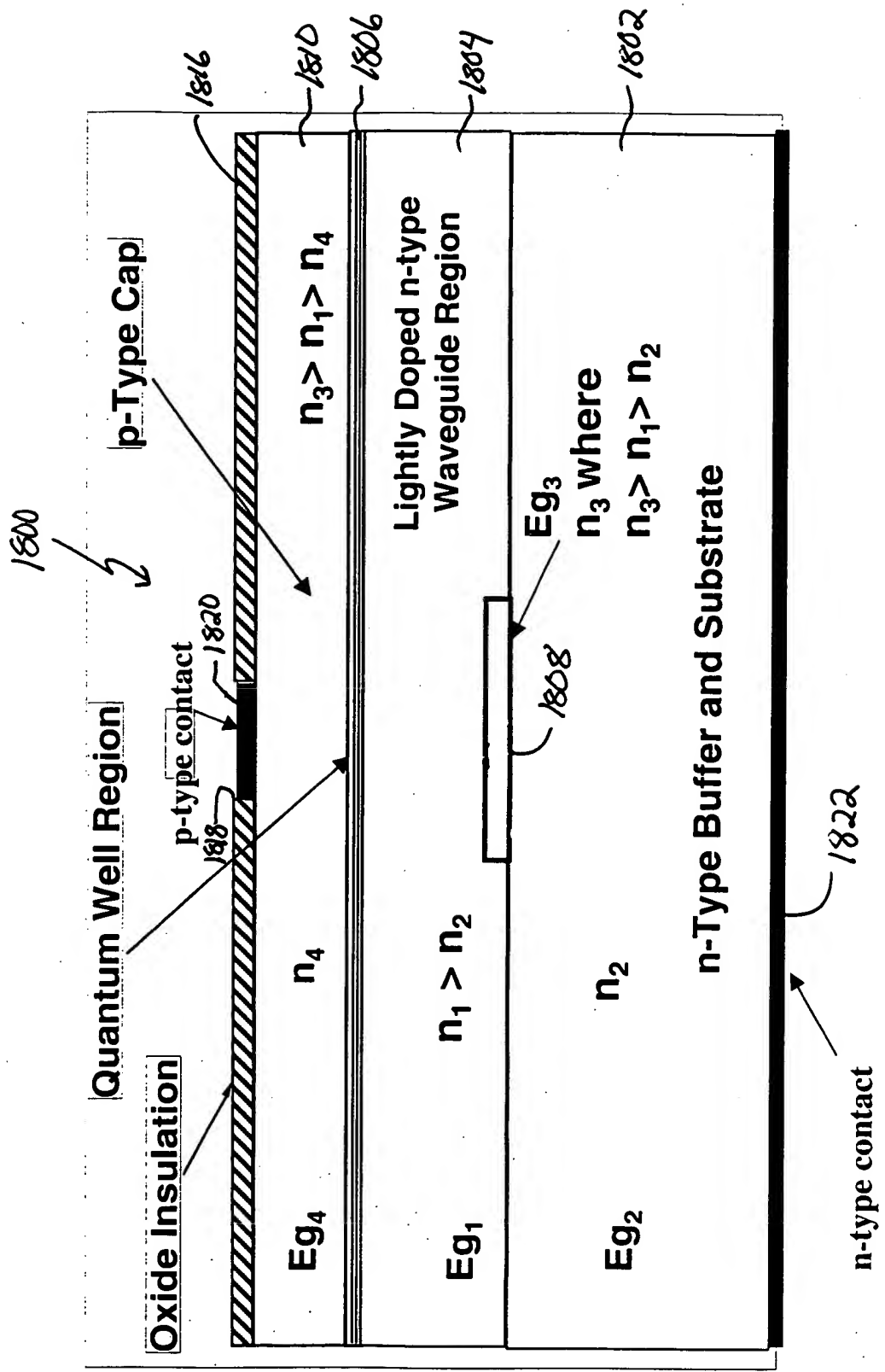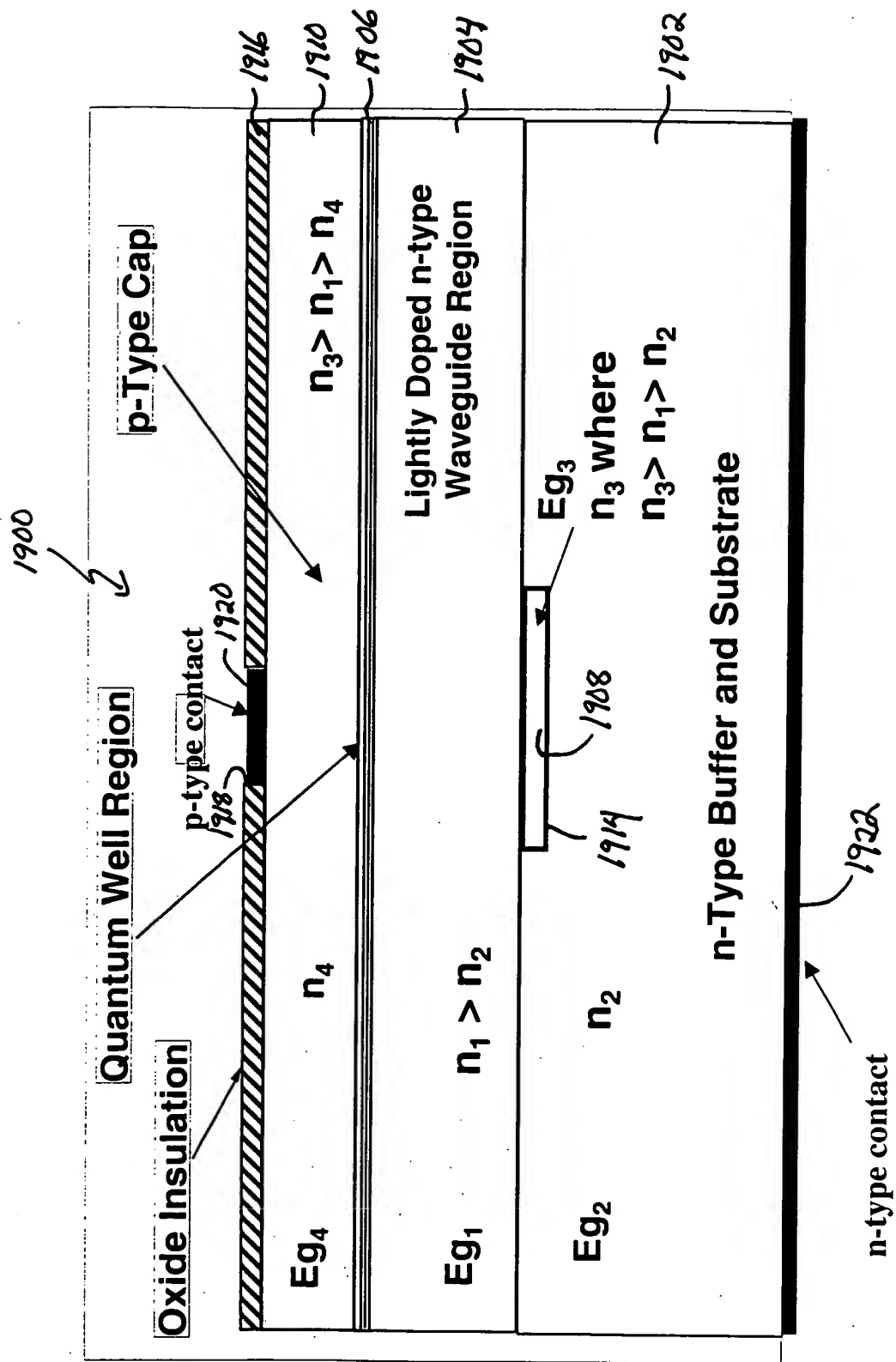
Fig. 18

Fig. 19

Fig. 20

2100

Quantum Well Region

n-Type Cap

2116

2108

$n_4 < n_1$

2104

$n_1 > n_2$

$n = 10^{17}$ cm^{-3} n-type

2106

2102

n_2

Oxide Insulation

n-type contact

2126

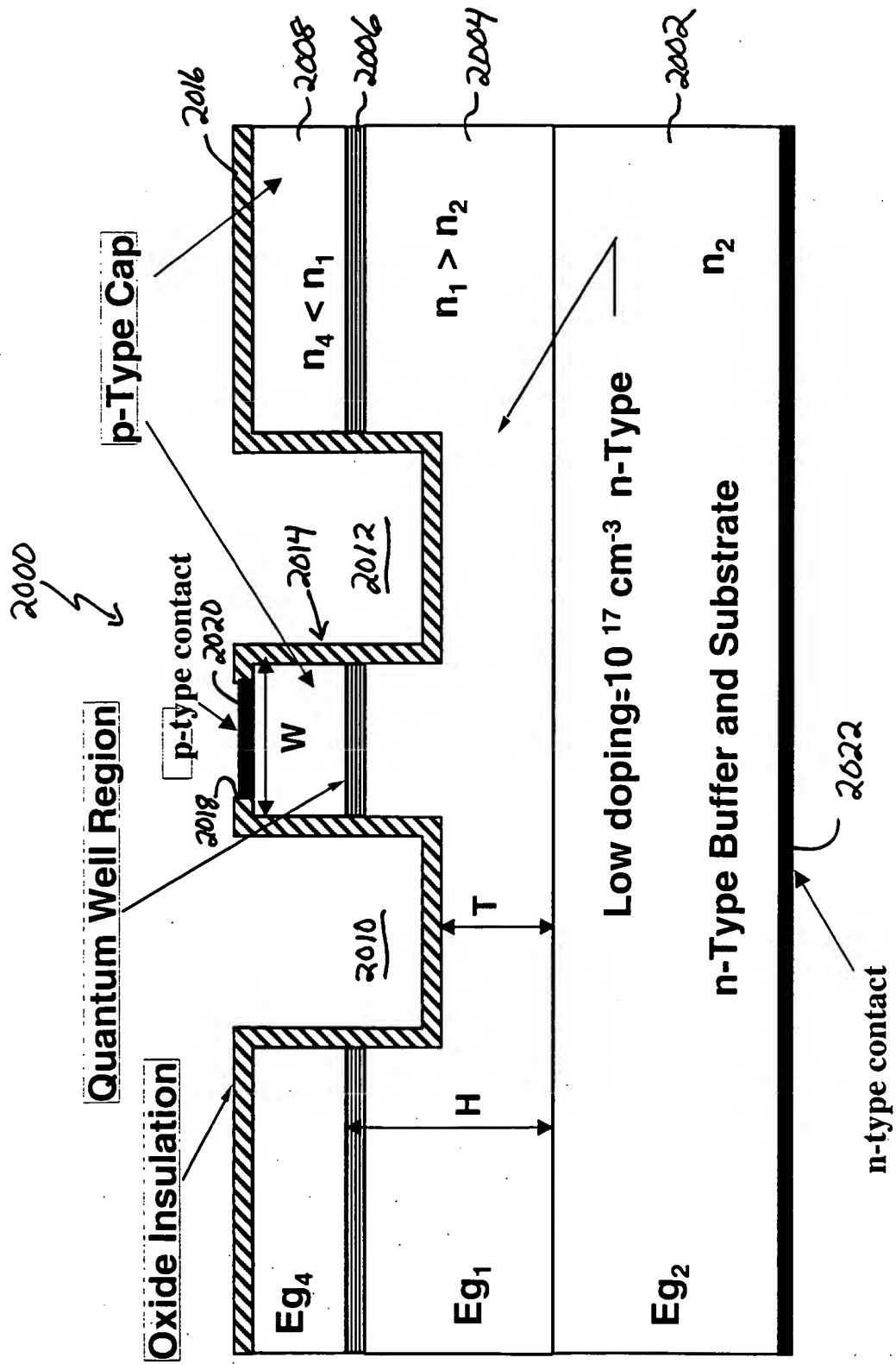2114

2112

2118

W

2110

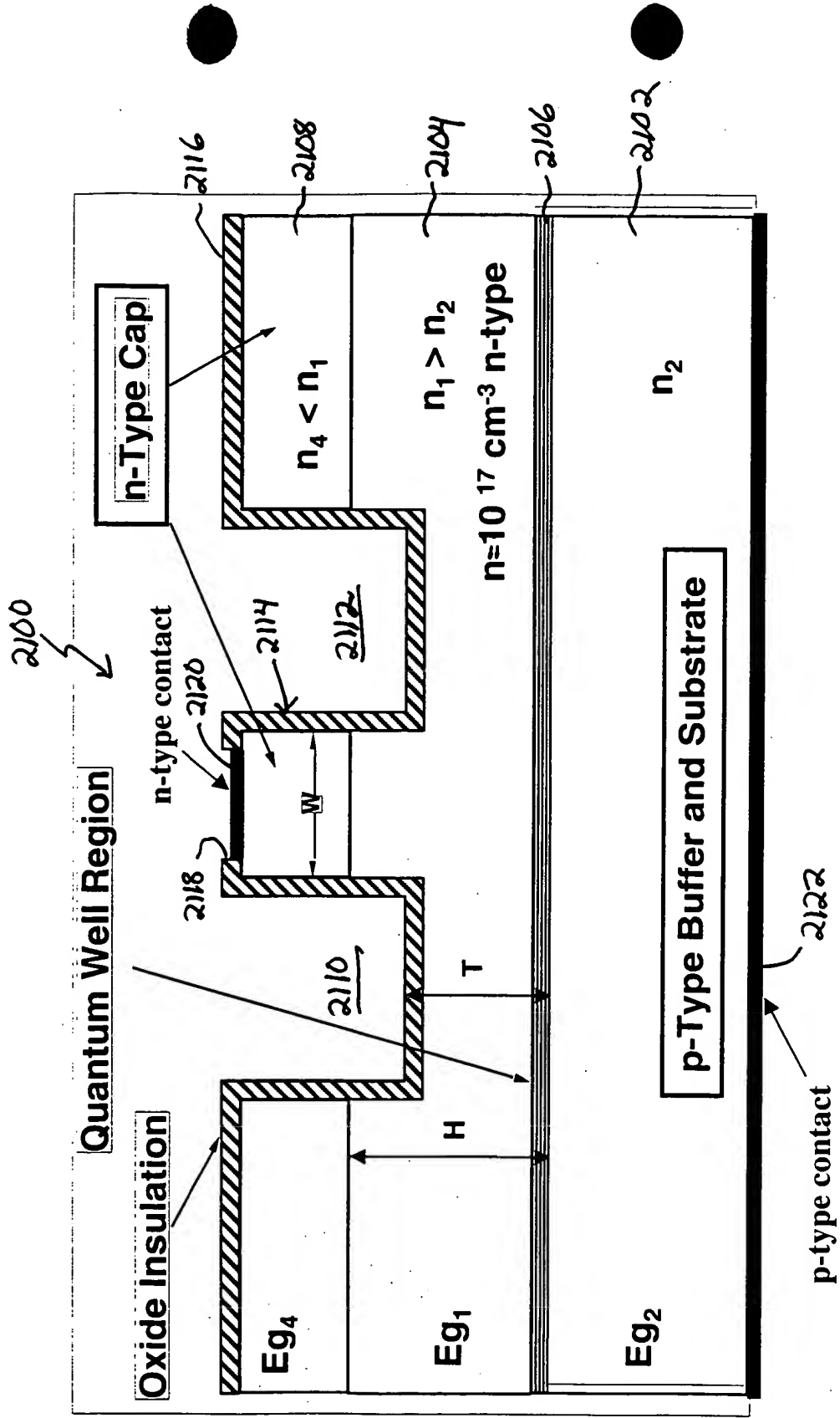T

H

Eg_4

Eg_1

Eg_2

p-Type Buffer and Substrate

p-type contact

2122

Fig. 21

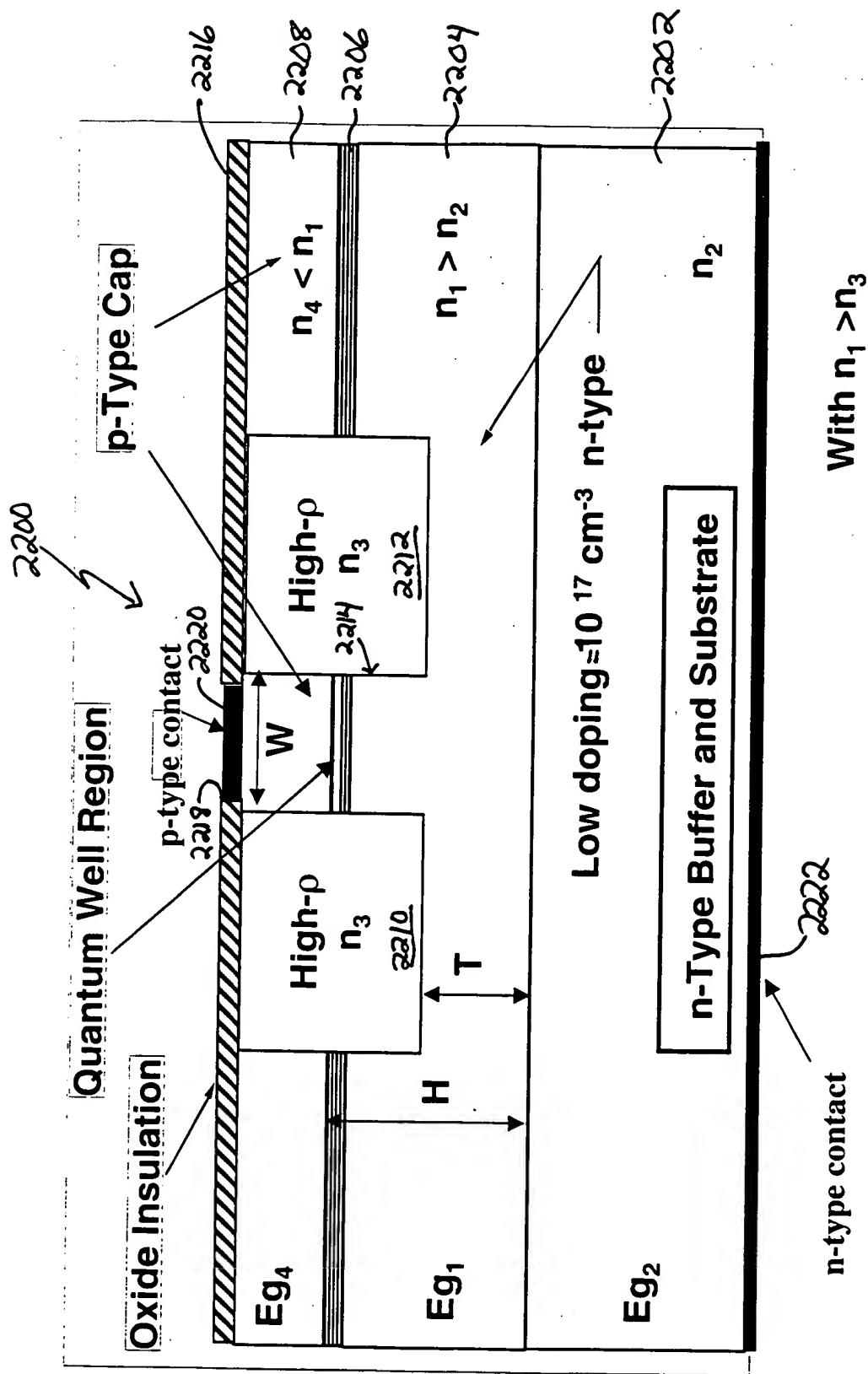Fig. 22
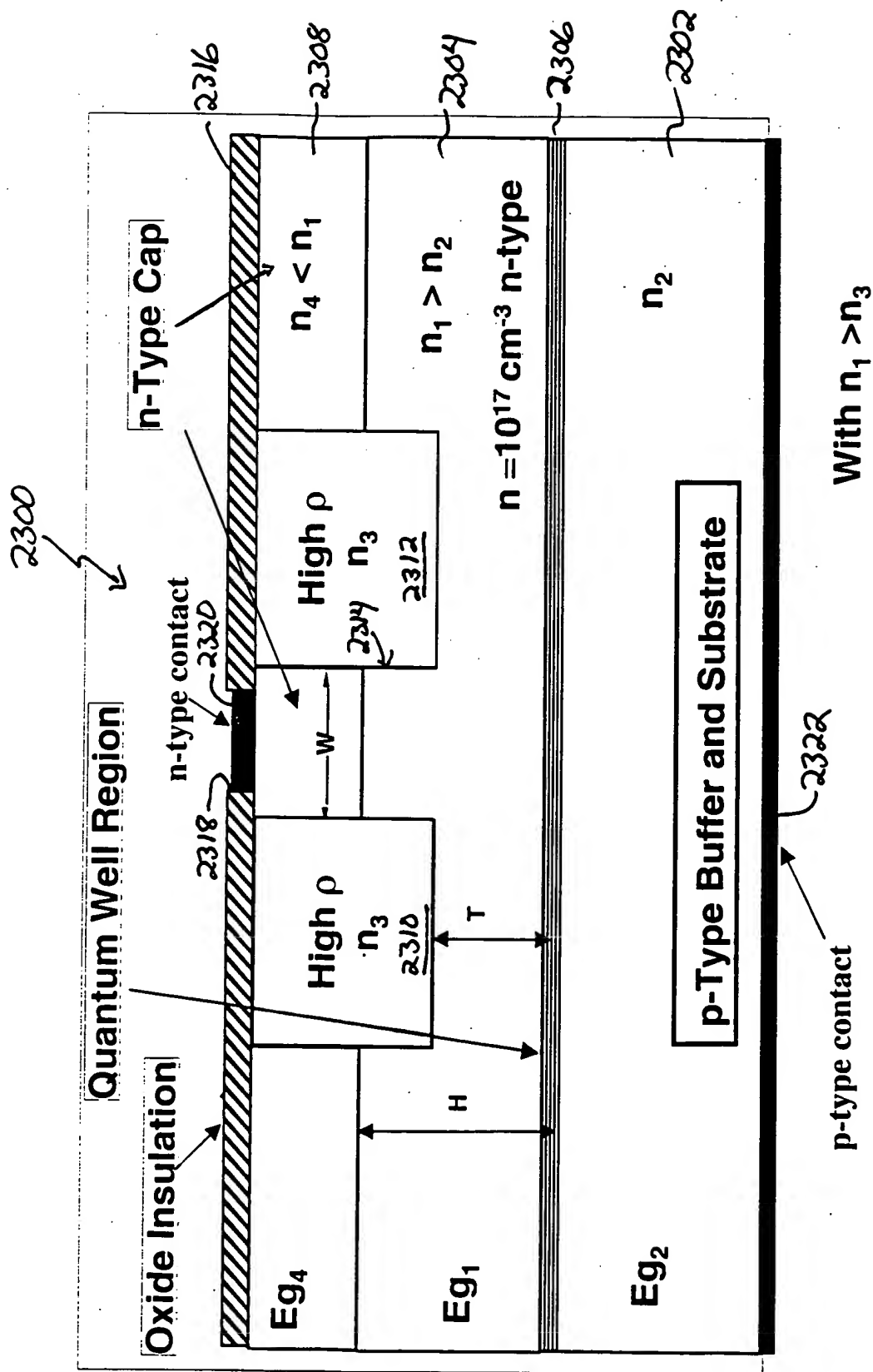
Fig. 23

Fig. 24

2500

Narrow Intrinsic Region

n-Type Contact 2520

2512

2508

2504

p-Type Contact

+ ○

○

p-Type

n-Type

Quantum Well Region

2516

E_{g4}

T

H

W

2506

2502

E_{g1}
undoped

2514

E_{g2}
undoped

Fig. 25